Designing and Testing a High Flow Rate Counterflow Atomizer System

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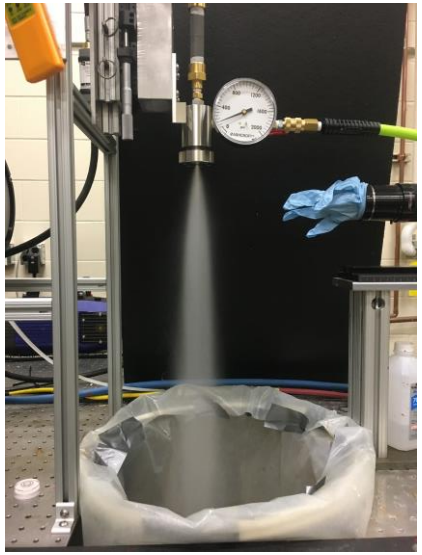
Introduction

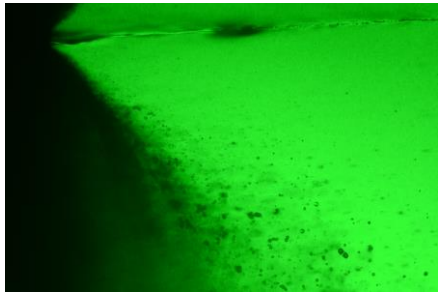
Atomization is a way of converting a liquid into fine droplets. One way to atomize a liquid is to accelerate a high-pressure gas alongside a liquid. The gas mixes and breaks up the liquid, turning the liquid into a fine mist of droplets. Atomizer nozzles are used in a variety of industries including spray drying, painting, and energy. Improving current commercially available nozzles would greatly impact these processes. In addition, it takes a vast amount of energy to pressurize the gas used in gas-assist atomization. Therefore, improving atomization will also benefit business and the environment. One way atomization can be improved is by creating a high flow rate counterflow atomizer system.

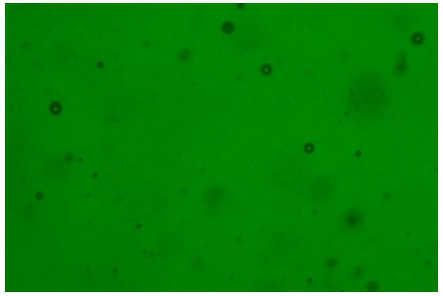
Methods

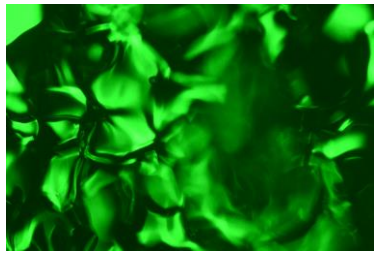
The AR Blue Clean pressure washer was used to increase the pressure of the water from the tap. Quick connects were used to decrease the amount of assembly time of the system. A valve was connected to the pressure washer in order to control the amount of water that was supplied to the nozzle. Air and water pressure gauges were also connected with to the hose to enable a more accurate reading than the air supply and pressure washer had. Pictures were taken of the spray (see Figure 2 and 3) using a high definition camera and a ND YAG laser. It was determined that the spray needed a higher air pressure in order to atomize the liquid. A nitrogen tank was then used to run the system and pictures were taken of the spray.

Results









Discussion

With the nitrogen tank added to the system, atomization was achieved until 1.6 GPM (see Figure 1) and once the liquid flow rate was increased past 1.6 GPM atomization did not occur. The nitrogen tank allowed for a higher air-pressure in order to better atomize the liquid. The droplets were a larger size than that of the original system so the zoom on the camera was reduced to half the size for the droplets to be in full view.

References

A. Hoxie, E. Johnson, V. Srinivasan, P. Strykowski, Characterization of a Novel Energy Efficient Atomizer Employing Countercurrent Shear, International Conference on Liquid Atomization and Spray Systems (IClass) 2018.

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